

United States
Department Of
Agriculture

Forest
Service

Shasta-Trinity
National Forests

Reply To: 3420

Date: October 18, 1989

Subject: Evaluation of Red Fir Mortality and Branch Flagging
in High Wind Blowdown Salvage Units, Salmon River
Ranger District (Report No. N89-21)

To: Forest Supervisor, Klamath National Forest

On September 20, 1989, Dave Schultz, entomologist, and I met with Barbara Busse and Don Osterhoudt, Salmon River Ranger District, to examine units in the proposed High Wind Blowdown Salvage area (T. 39 N., R. 10 W.). The District wanted information that would aid them in identifying probable salvage trees that could be included with the blowdown in any salvage operation. They also wanted pest management input to the development of silvicultural prescriptions for the long-term management of the stands.

The main species in these stands is red fir. Small quantities of white fir and mountain hemlock are also present. Stand structure and canopy cover varies between units, but most have at least 2 or 3 layers with large sawtimber comprising the top layer. Storm damage was present in some units, including windthrow and stem breakage.

Levels of red fir mortality are higher than they have been in the recent past. The fir engraver, Scolytus ventralis, fir roundheaded borer, Tetropium abietis, and several other species of Scolytus were involved in this mortality. A considerable number of trees with green foliage had patch kills of cambium along the bole from insect attacks which could result in mortality. Many of the large overstory trees are infected by red fir dwarf mistletoe, Arceuthobium abietinum f.sp. magnificae. These trees have considerable branch flagging. This flagging is due to the interaction of dwarf mistletoe, Cytospora canker (caused by Cytospora abietis), lesser species of Scolytus, and drought. Although branch mortality reduces the level of dwarf mistletoe in a tree, it also reduces the amount of live crown and increases crown raggedness which can aid in predisposing the tree to mortality.

Predicting the probability of red fir mortality over the short-term is difficult at best. Systems have been developed to improve the accuracy of such predictions using readily recognizable characteristics. The main crown characteristics include crown raggedness and live crown percent. Both of these are being altered in many of the overstory trees by the increased level of branch flagging. To utilize the system, a level of probability of mortality over a prescribed period of time has to be determined that is acceptable. This system predicts the proportion of identical trees expected to die over the next 5 years. Even with the use of such a system, some trees will be removed that would otherwise live and some trees that are left will die. Detailed information on the use of this system can be obtained from the following

publication: "Ferrell, G.T. 1980. Risk-rating systems for mature red fir and white fir in northern California. Gen. Tech. Rep. PSW-39. 29p. Pacific Southwest Forest and Range Exp. Sta., Berkeley, CA". A summary of the system is included as an enclosure with this report.

The following management alternatives are provided as input to the development of long-term silvicultural prescriptions for these stands. They are directed to the management of the stands and the effects of any activities on pest incidence and impact.

MANAGEMENT ALTERNATIVES

1. No Action. Mortality of red fir will be high through 1990, with trees attacked by the fir engraver in 1989 fading throughout next summer. The level of mortality in 1991 will depend partly on the amount of precipitation received this winter. If normal to above normal levels occur, then mortality should return to "normal", although several years may be required for this to occur. If precipitation remains below normal, then mortality can be expected to increase. Regardless of the amount of precipitation received, mortality levels in these stands can be expected to be higher than managed stands because of their age, the amount of dwarf mistletoe, and the poor crown conditions. Any red fir regeneration that occurs in these stands will become infected by dwarf mistletoe which will result in stunting and deformation.
2. Salvage. Dead trees and those expected to die within the next year will be removed. Some suggested marking guidelines developed on other Forests are included to aid in identifying trees for salvage purposes. The amount of additional mortality will not be affected and will be the same as with no action. If precipitation levels do not recover, then mortality may be increased by any salvage operation because of the additional disturbance to the stand and stress added to the green trees. Care during any logging activities will be necessary to reduce the amount of basal injury to leave trees and subsequent decay. Restrictive timber sale clauses and penalties should be considered for implementation in these stands to reduce leave tree injury. Salvage operations will cause some site disturbance that may increase natural regeneration of red fir. As long as a dwarf mistletoe-infected overstory remains, this regeneration will become infected and be stunted and deformed.
3. Stand Management. Silvicultural prescriptions will be prepared and implemented for each stand with one of the objectives being to promote healthy and vigorous forest vegetation. Management objectives will influence the type of prescription developed for each stand, but the following provides a range of treatments and the pest prognosis with the implementation of each.
 - a. Regeneration. A stand would be regenerated using either a clearcut or shelterwood. The stand would be planted with a species mix, the principal component being red fir. White fir could be a minor component. Mountain hemlock can be expected to seed into many of the stands. Stand boundaries should be adjusted, where practical, to reduce the amount of edge adjacent to residual dwarf mistletoe infected stands. Where this is not practical, the proportion of white fir should be increased along the boundary to reduce the

impact and rate of spread of red fir dwarf mistletoe into the new stand. If a shelterwood is employed, then the overstory trees must be removed within 10 years of regeneration to limit dwarf mistletoe infection of the regeneration in stands with dwarf mistletoe.

Assuming the new stands are managed, the long term effect would be to reduce the amount of dwarf mistletoe and to replace slow growing trees with younger, more rapidly growing trees, thereby increasing site productivity. Tree mortality levels will be lowered in these stands for many years.

b. Overstory Removal. Stands with adequate amounts of advanced regeneration could undergo an overstory removal. Stands appropriate for this prescription require adequate stocking of suitable regeneration and volumes in the overstory that will not result in unacceptable damage to the understory when harvested. Precommercial thinning of the understory may be required in some areas following overstory removal to assure adequate growth. If the understory is allowed to grow sufficiently in height, residual dwarf mistletoe infections will not impact the new stand as long as the overstory source of infection has been removed. The level of tree mortality in these stands will be lower after the stands have been replaced with younger, better growing trees.

c. Commercial Thinning. The level of growing stock in a stand would be reduced by harvesting some trees. Selection criteria should include non-desirable characteristics, such as dead tops, goosepens, heavy dwarf mistletoe infection, and low live crown ratio, as well as removing trees from the lower crown classes. A compromise on the level of growing stock left may need to be made to maintain an adequately stocked stand and still remove many of the less desirable trees. It is not known if reducing the amount of growing stock on a site in red fir stands reduces the amount of future tree mortality, but this principle does apply to other tree species and appears reasonable to assume for red fir. A growth response in the leave trees should not be anticipated because of their age. Care during logging should be taken to reduce injuries to the leave trees and subsequent decay. Some natural regeneration may occur in the stands because of the exposure of mineral soil during logging activities. Any red fir regeneration will become infected by dwarf mistletoe in stands with overstory trees infected.

d. Sanitation/Salvage. Only dead trees and those expected to die within a prescribed period of time would be removed. Guidelines for selecting trees to remove were discussed above and in the enclosure. This method would recover wood volume before it is unmerchantable and, in the case of sanitation trees, while it is still green. The number of entries required to recover the same volume would be reduced from what would be required with a strict salvage operation. Logging damage to residual trees could be a problem if care and restrictions were not applied during harvest. There would be a minimal effect on the amount of dwarf mistletoe in a stand. Mortality would be reduced for a few years because of the removal of trees likely to die in the near future. Mortality would increase after that short period and return to previous levels, depending on the amount of precipitation.

Forest Supervisor, Klamath NF

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If you have any questions about this evaluation or require additional pest management assistance, please contact Gregg DeNitto (916-246-5101) or Dave Schultz (916-246-5087) at the Shasta-Trinity S.O.

/S/ Gregg DeNitto

GREGG DeNITTO
Northern CA FPM Service Area

Enclosures

RISK RATING SYSTEM FOR RED FIR
(From Ferrell, G.T. 1980. USDA FS Gen. Tech. Rep. PSW-39)

RISK PREDICTORS

Crown Class - dominant, codominant, intermediate, suppressed
Live Crown Percent (to nearest 10 percent) - percentage of total tree's
height occupied by live crown
Top Condition - recent topkill with faded foliage only
Ragged Percent (to nearest 10 percent) - combined percentage of crown
missing, dead, and/or dying above lower limit of live crown

AWARD-PENALTY SYSTEM

I. Points are given to each risk predictor according to the following
schedule. Award points for crown class and live crown percent, penalty points
for top condition and ragged percent.

Crown Class

Suppressed..... 0
Intermediate..... 2
Codominant..... 4
Dominant..... 6

Live Crown Percent..... 5 points for each 10%

Sum the result = Award Total

Recent Top Kill..... 1

Ragged Percent..... 4 points for each 10%

Sum the result = Penalty Total

II. Probability of Mortality within 5 Years

Award equals or exceeds Penalty \leq 20 percent

Penalty exceeds Award by

1-4 points.....	21-30%	15-17.....	60-70%
5-8.....	30-40%	18-21.....	70-80%
9-11.....	40-50%	22-25.....	80-90%
12-14.....	50-60%	<u>>26.....</u>	<u>>90%</u>

RED FIR MARKING GUIDELINES (From Placerville Ranger District)
(Trees expected to die within 3-6 months)

Trees may be marked if they meet the following conditions:

- 1) 1/3 or more of the crown recently dead from the top
- 2) 1/3 or more of any contiguous area of the crown dead-not scattered branches
- 3) 2/3 or more of the crown area affected by scattered dead branches
- 4) Older dead top 1/2 or more of the crown length
- 5) Older dead top less than 1/2 of the crown length if other factors such as cankers, breaks, rot, etc. are present and in the markers's judgement will cause the tree to fall or die within 3 to 6 months
- 6) Boring dust collected in bark cracks
- 7) A combination of crown decline symptoms and numerous, fresh, clear pitch streamers on the bole